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An Overview of Water Quality Projects in the Rolling and High Plains

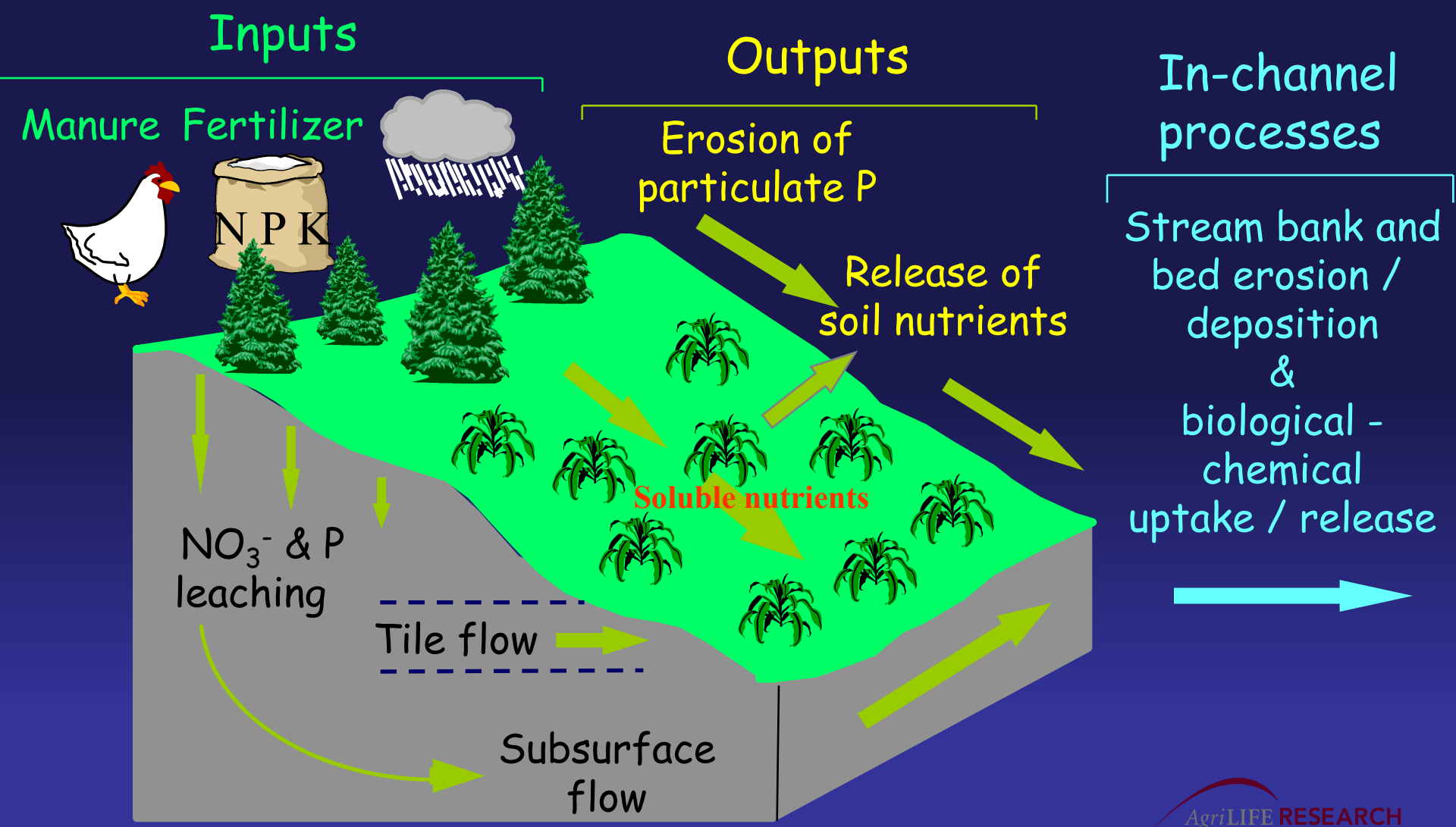
Paul DeLaune
Environmental Soil Scientist
Texas AgriLife Research at Vernon

March 2011, Canadian/Red River Basin Advisory Committee

Objectives

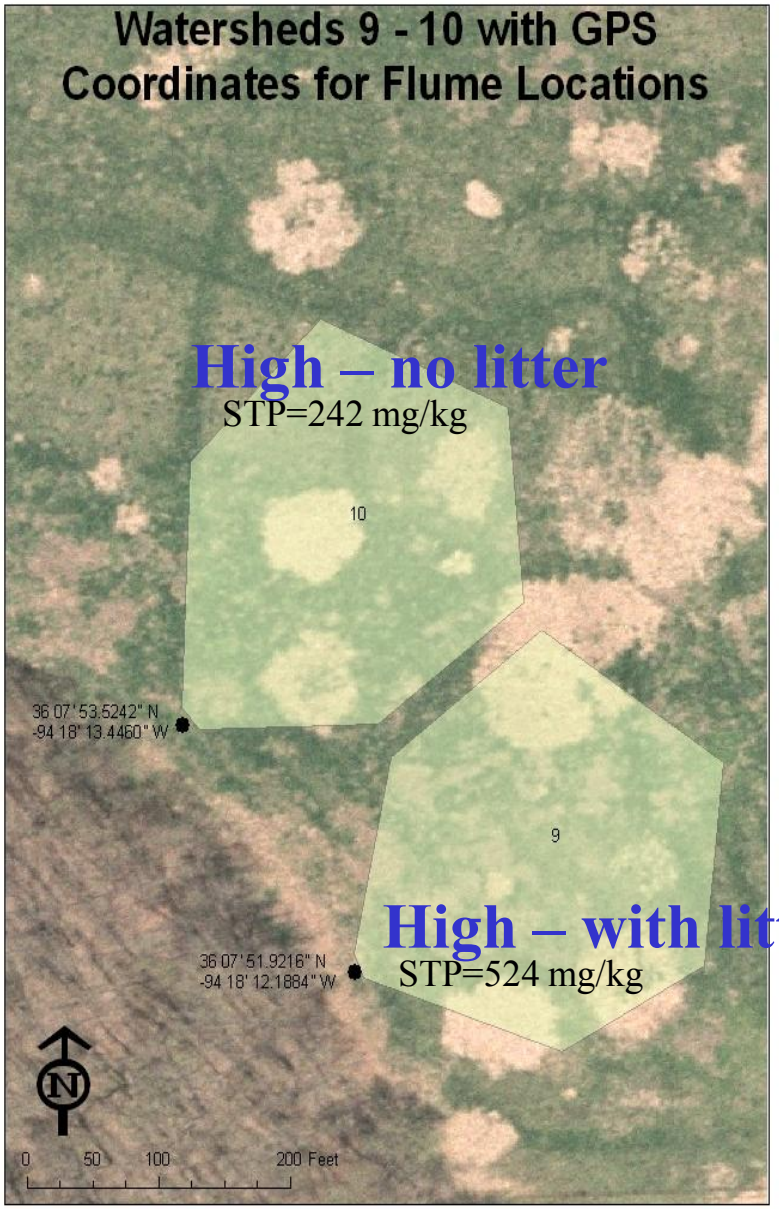
- Goals and objectives of Environmental Soil Science Program
- Summarize selected ongoing projects within the Texas Rolling and High Plains

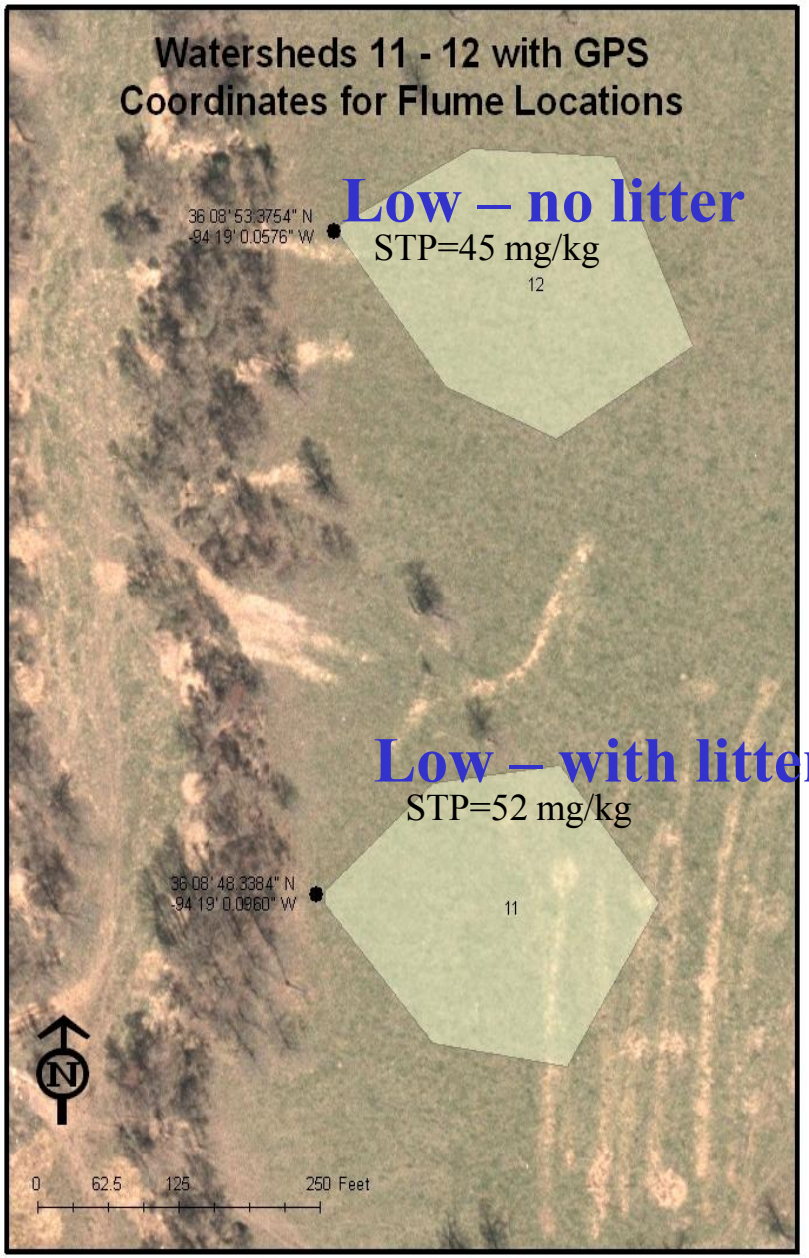
Pathways of Transport

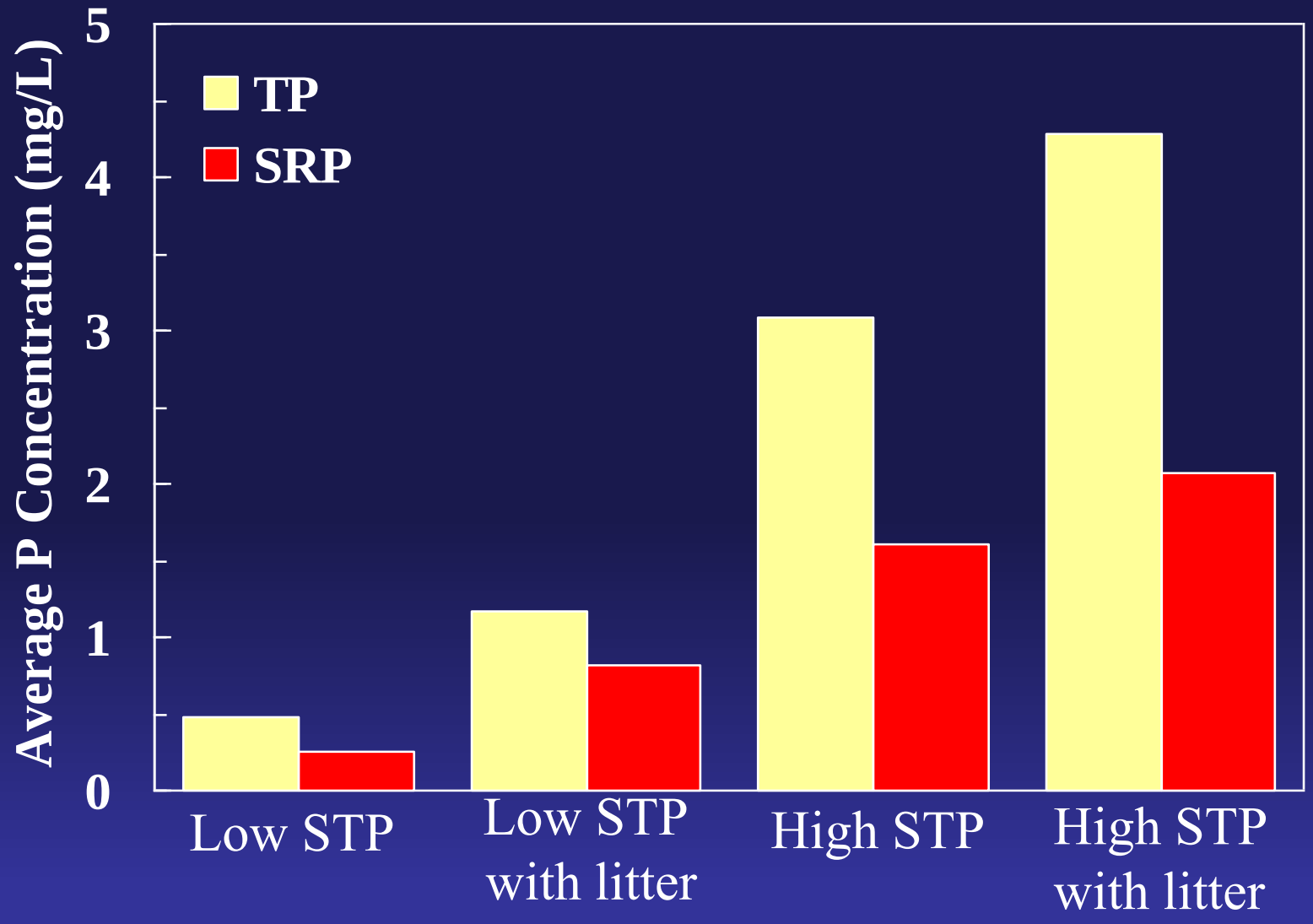


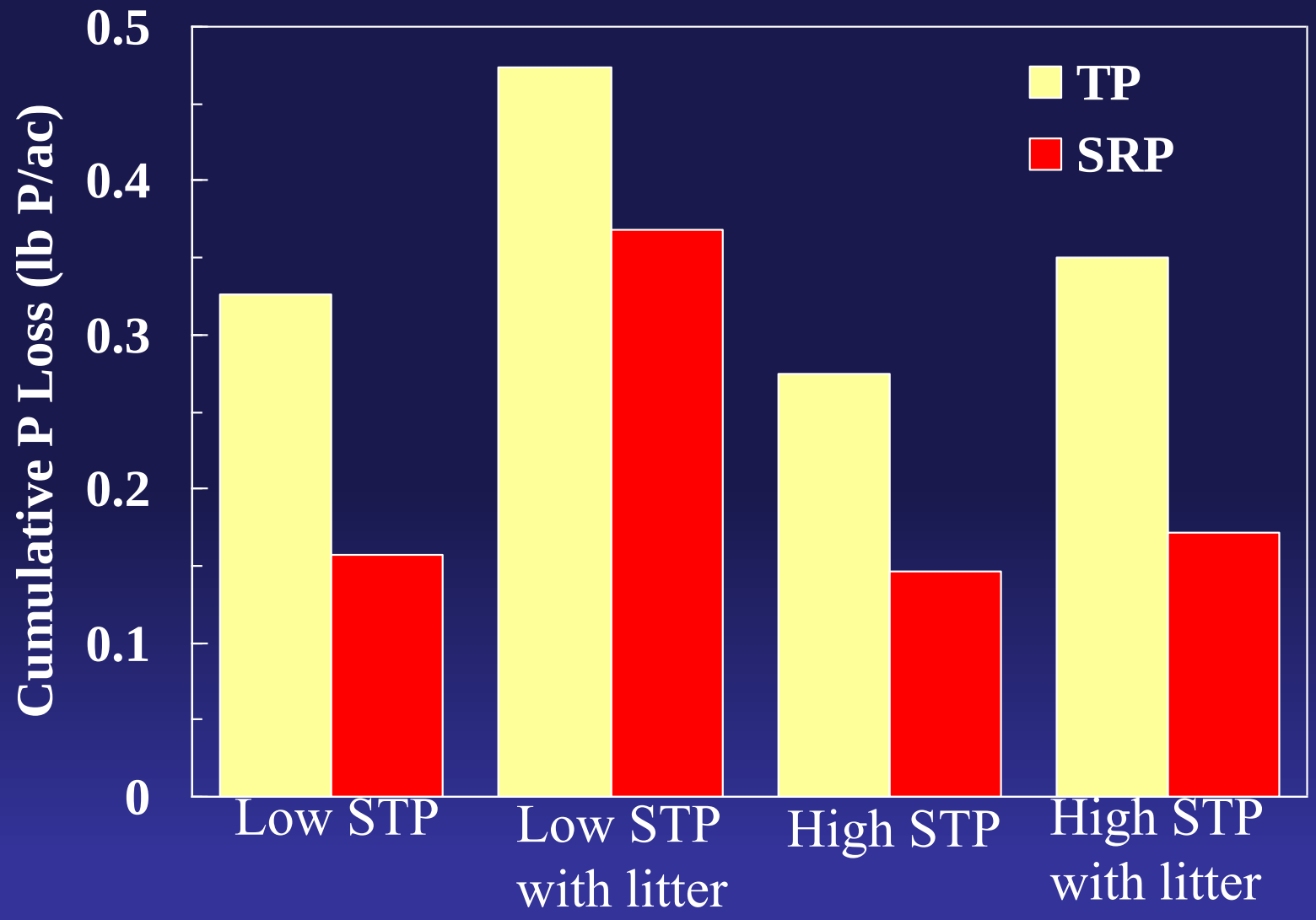
Monitoring Methods

- In-stream sampling
  - Verify Impairment
  - Identify Source
  - Implement specific, cost-effective BMP
- Small plot (rainfall simulations)
  - Relative comparison among given set of treatments
- Edge of Field Monitoring
  - single largest scientific and management gap for addressing contaminant loss


Watersheds 9 - 10 with GPS Coordinates for Flume Locations
High – no litter
STP=242 mg/kg
10
36 07' 53.5242" N
-94 18' 13.4460" W
9
High – with litter
STP=524 mg/kg
36 07' 51.9216" N
-94 18' 12.1884" W
N
0 50 100 200 Feet


Watersheds 11 - 12 with GPS Coordinates for Flume Locations
36 08' 53.3754" N
-94 19' 0.0576" W
Low – no litter
STP=45 mg/kg
12
Low – with litter
STP=52 mg/kg
36 08' 48.3384" N
-94 19' 0.0960" W
11
N
0 62.5 125 250 Feet





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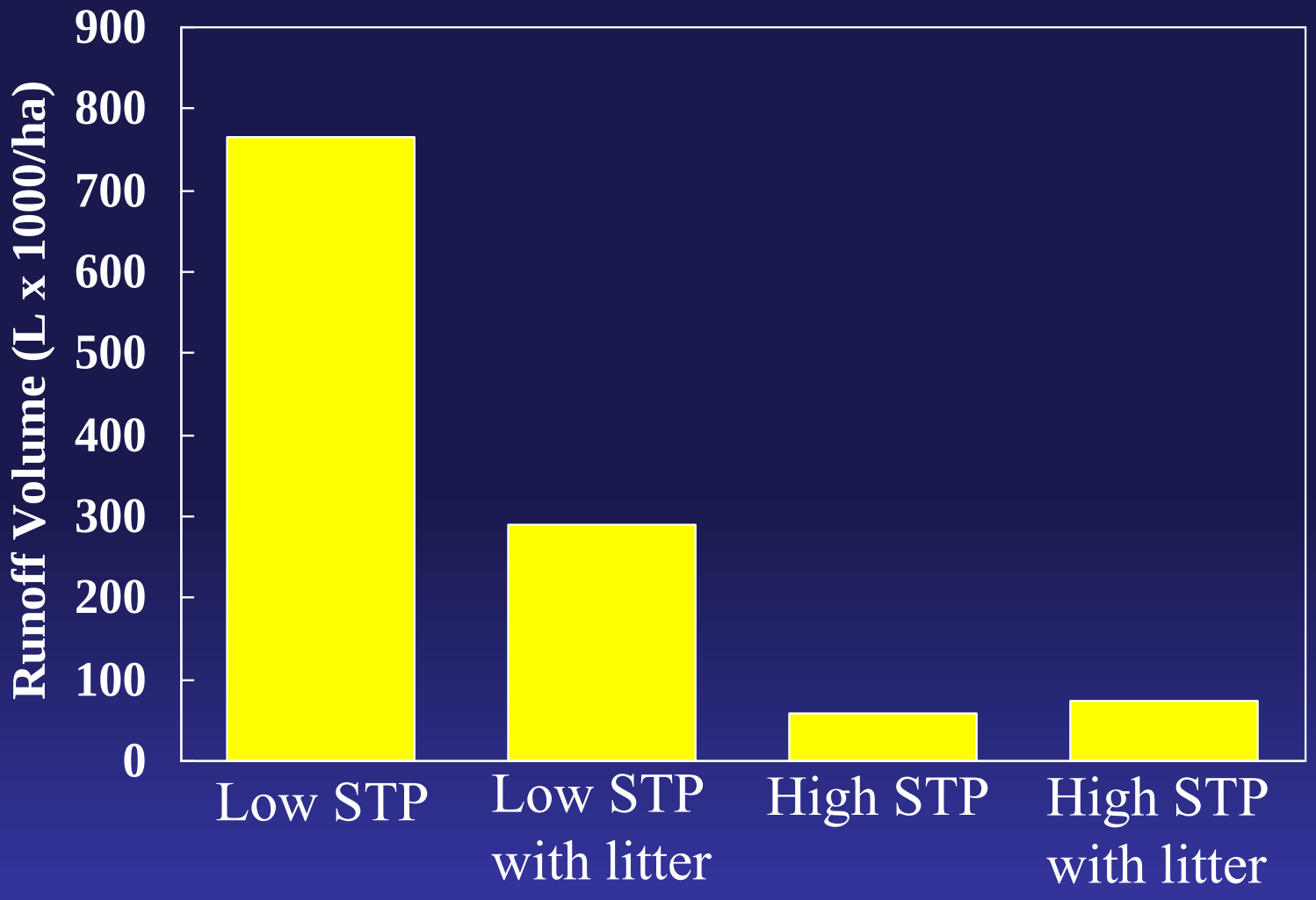

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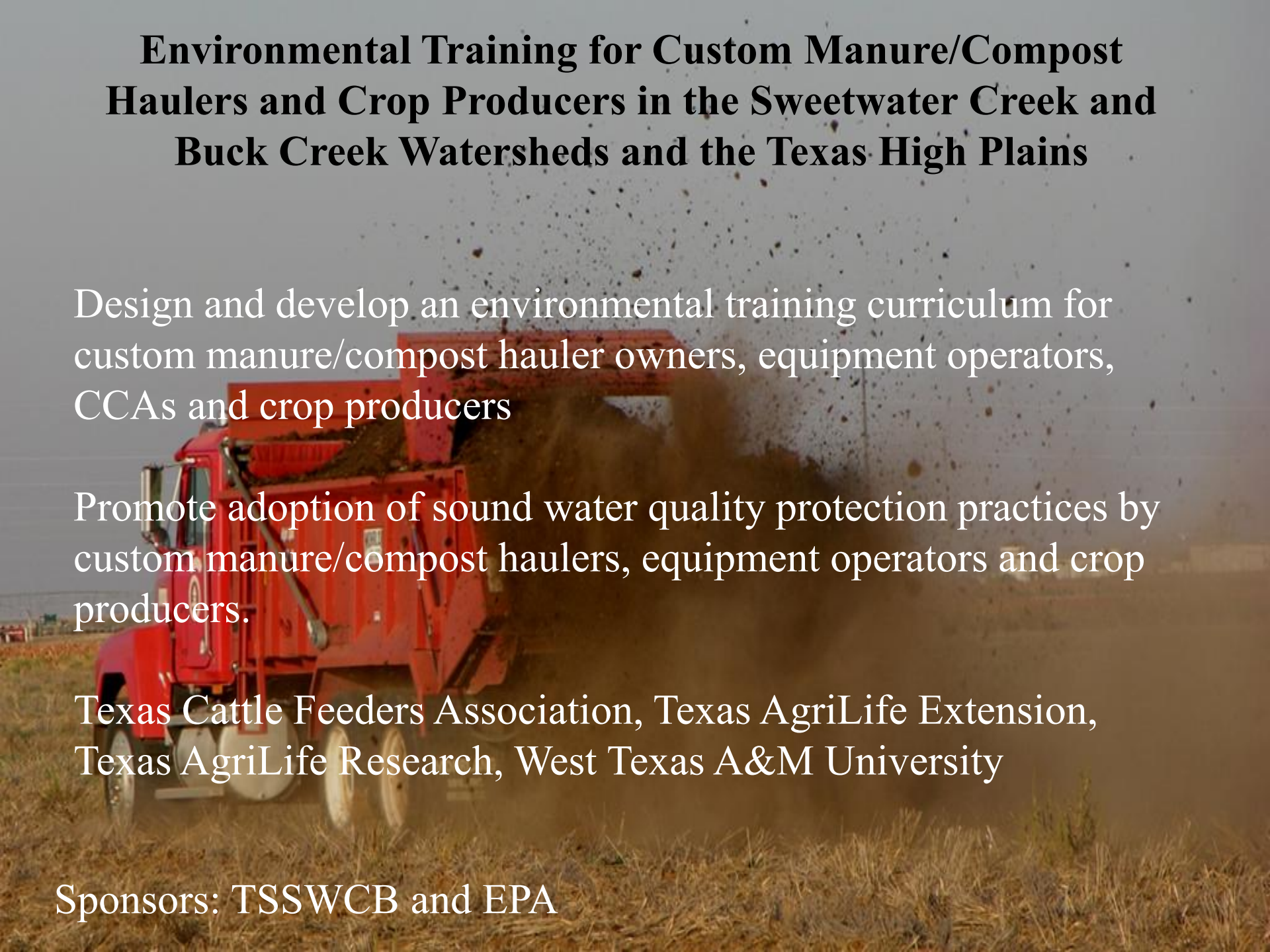
Environmental Training for Custom Manure/Compost Haulers and Crop Producers in the Sweetwater Creek and Buck Creek Watersheds and the Texas High Plains



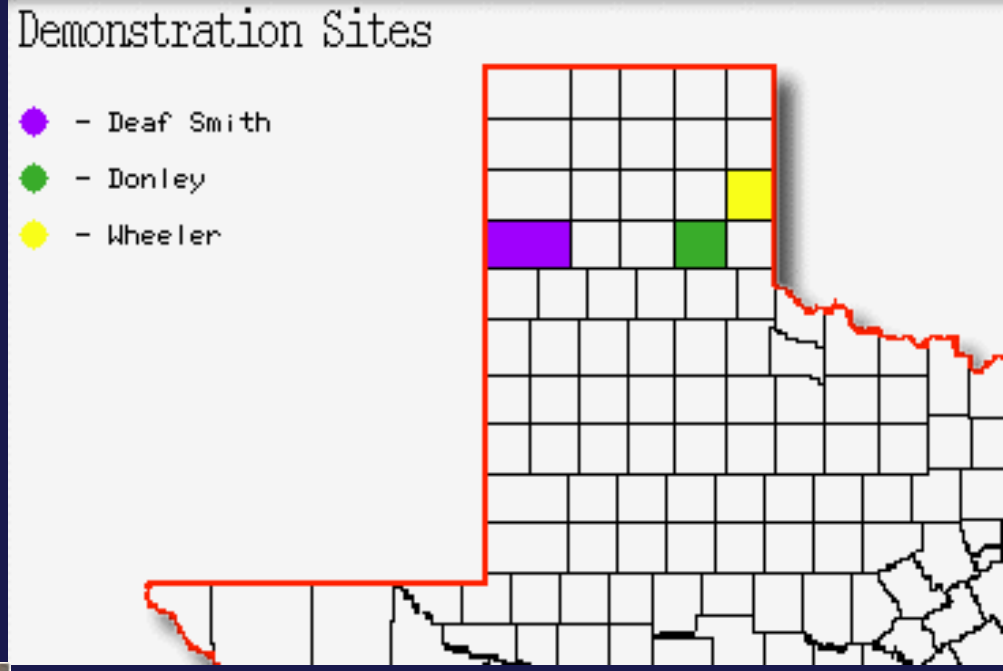
Design and develop an environmental training curriculum for custom manure/compost hauler owners, equipment operators, CCAs and crop producers

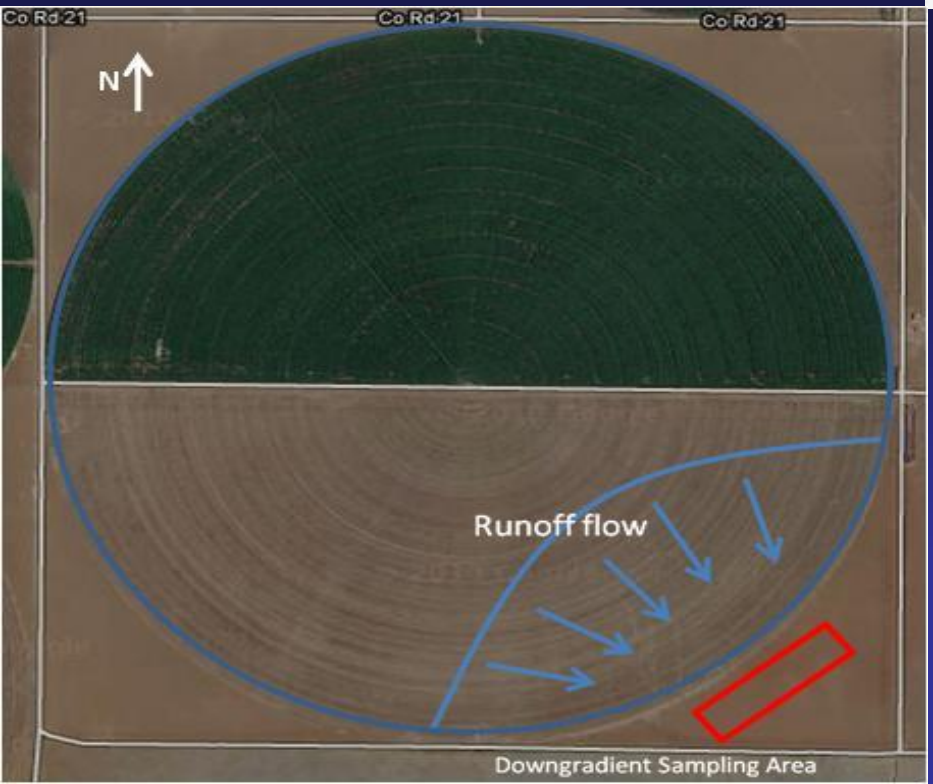
Promote adoption of sound water quality protection practices by custom manure/compost haulers, equipment operators and crop producers.

Texas Cattle Feeders Association, Texas AgriLife Extension, Texas AgriLife Research, West Texas A&M University

Sponsors: TSSWCB and EPA

Multiple:
locations
soil series
crop types
tillage practices
fertilizer types
application timing





Down gradient Soil Sampling
pH
Soluble salts
N, P, K, Ca, Mg, S, Na

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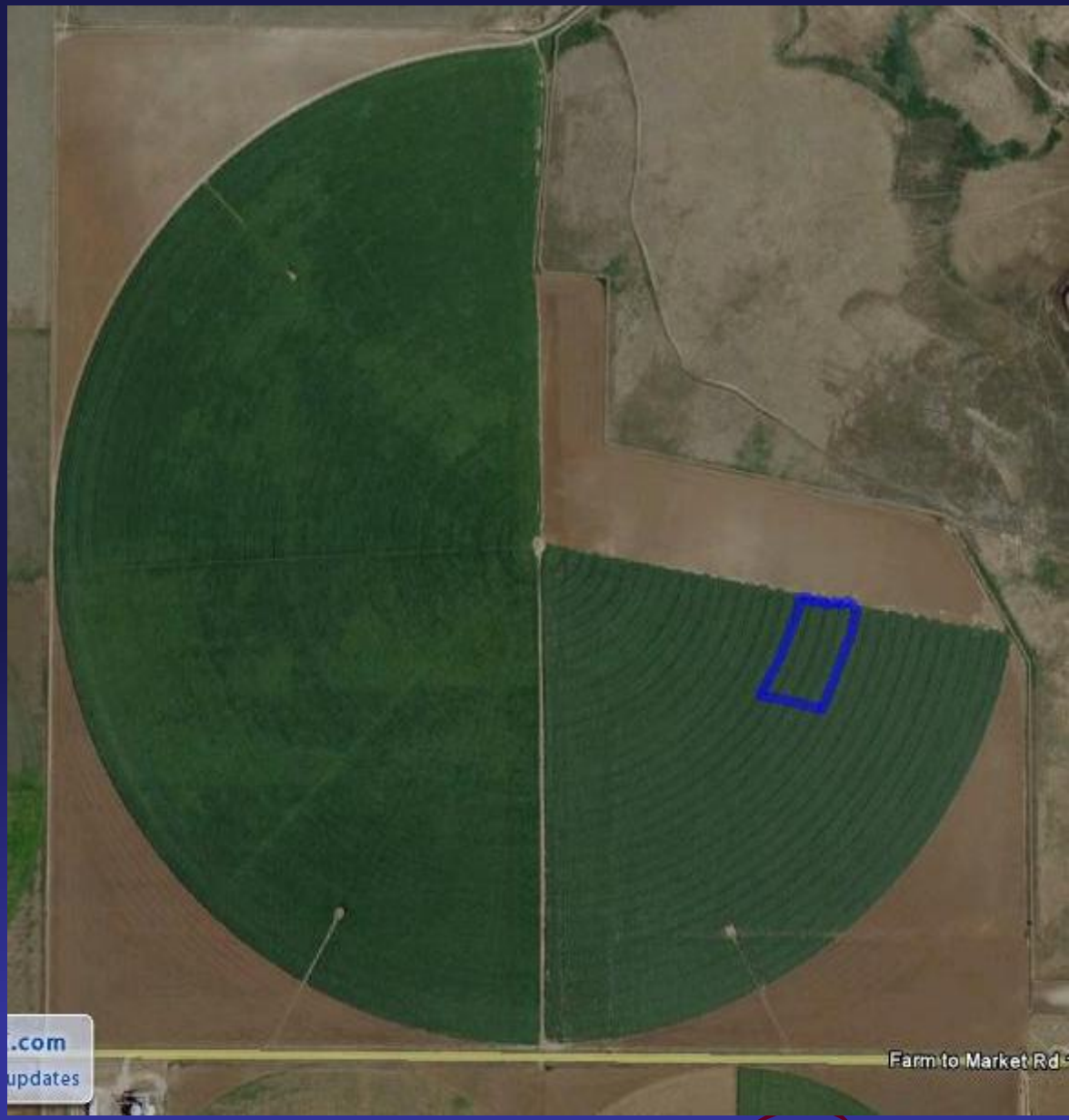
Water Quality Runoff Plots

Deaf Smith County

Fertilizer Treatments
- 10 T/ac manure/yr
- 20 T/ac manure/3 yr
- 4 T/ac compost/yr
- Commercial fertilizer

Water Quality
- Nutrients (N & P)
- *E. coli*



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Plot Construction

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Distillers Grains

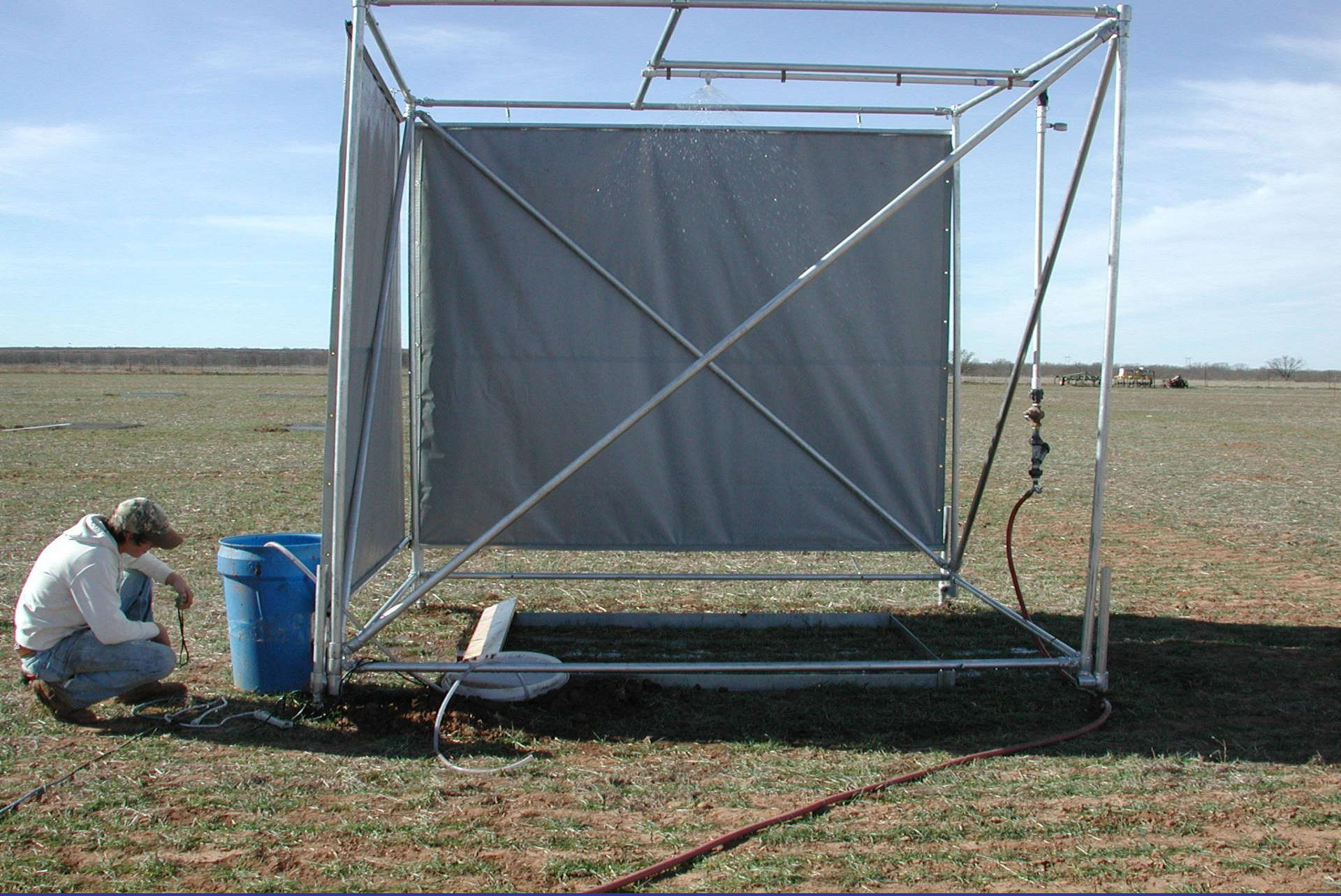
- ✓ Determine the impact of feeding WDGS on P concentrations in manure and surface runoff.

- ✓ **6 Diets Evaluated**
  - **Steam Flaked Corn**
  - **Dry Rolled Corn**
  - **Steam Flaked Corn with WDGS @**
    - **15%**
    - **30%**
    - **45%**
    - **60%**

Sponsor: TCFA

Manure Nutrients

	Total N (%)	Total P (%)	WEP (mg/kg)
DRC	3.18	0.84	1855
SFC	3.28	1.01	1982
15%	3.33	1.07	2587
30%	3.54	1.07	2573
45%	3.80	1.37	2885
60%	4.34	1.61	2925



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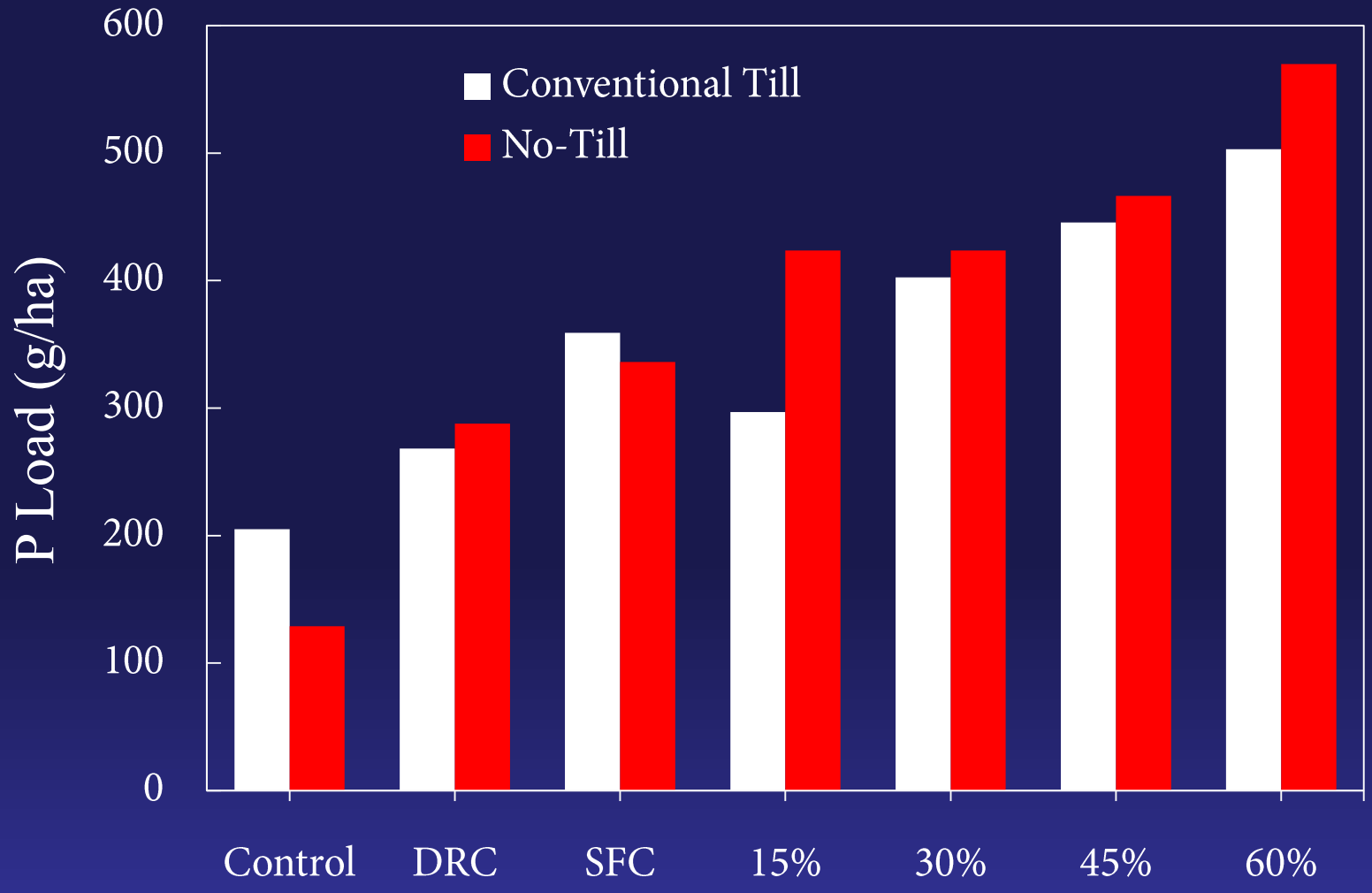

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Groundwater Nitrogen Source Identification and Remediation in the Texas High Plans and Rolling Plains Regions

- ✓ Quantify Relative Inputs of Natural and Fertilizer Nitrogen in the Texas High Plains (UT-BEG)
  - 74% (median) of total nitrate inventories in soil profiles is from mineralization of natural SOM in the soil profile that developed during initial cultivation.
- ✓ Evaluation and Demonstration of Nitrogen Remediation Strategies (Texas AgriLife Research at Vernon)
  - Nitrate Crediting

Sponsor: TSSWCB and EPA

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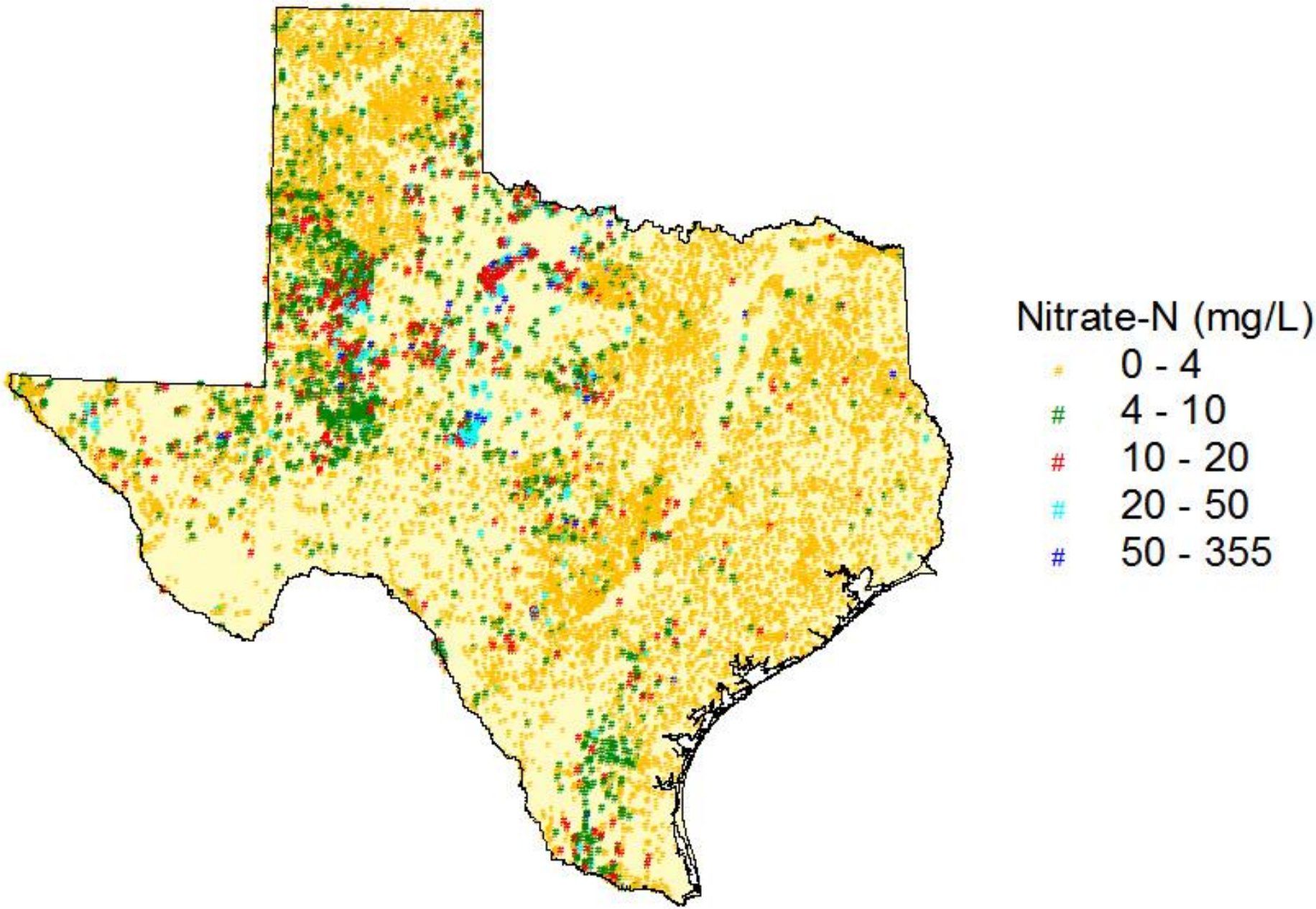
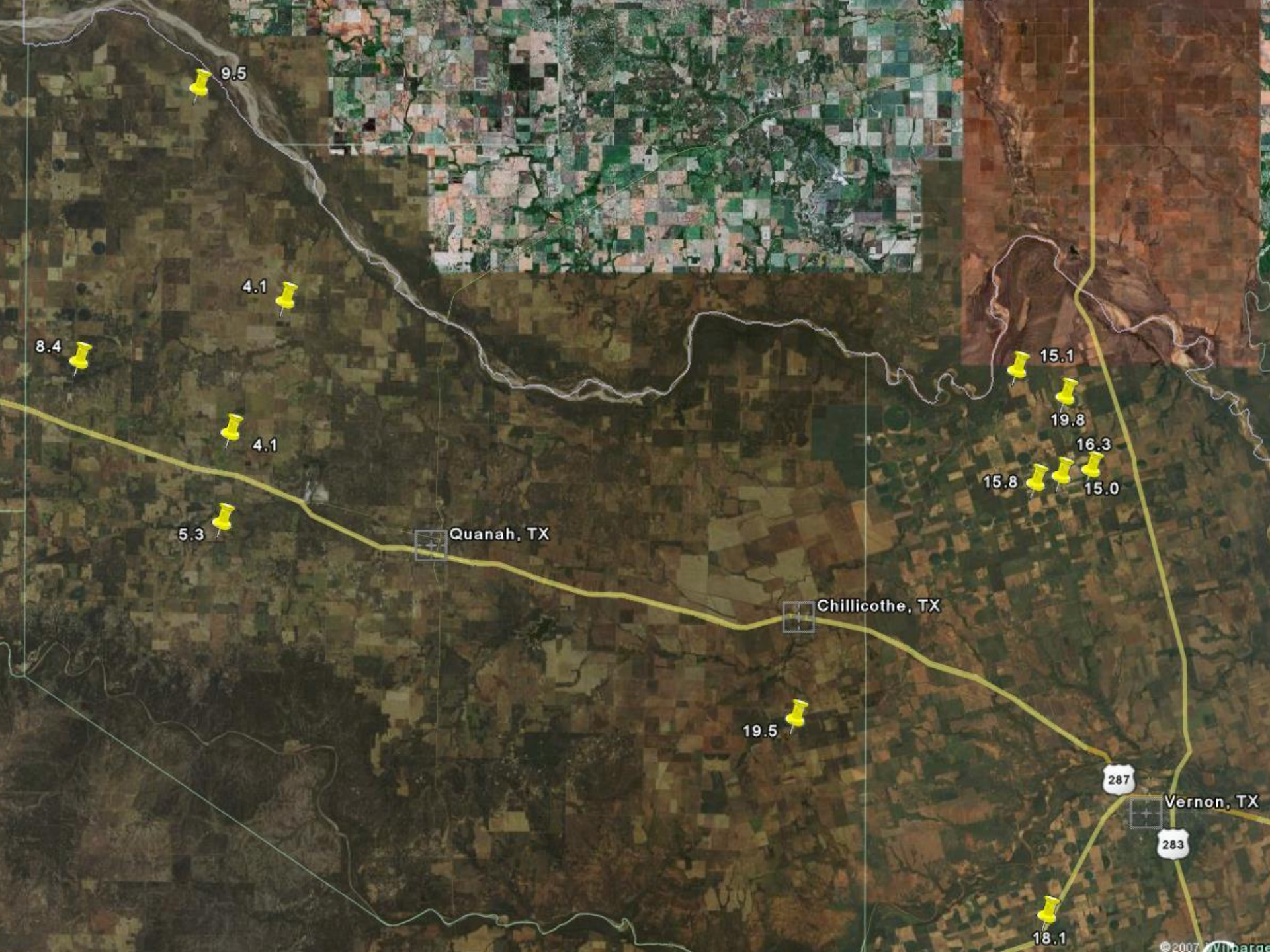


Figure 1. Distribution of NO_3-N in groundwater in Texas (TWDB Data).


9.5
4.1
8.4
4.1
5.3
Quanah, TX
15.1
19.8
16.3
15.8
15.0
Chillicothe, TX
19.5
287
Vernon, TX
283
18.1

Nitrate Applied Through Irrigation

lbs N/acre = NO_3 (ppm) x 0.23 x inches of water applied/acre

Well Water NO_3^- (ppm)	------Inches of Water Applied------				
	6	12	18	24	30
	----------lbs N/acre----------				
5	7	14	21	28	35
10	14	28	41	55	69
15	21	41	62	83	103
20	28	55	83	110	138
25	34	69	104	138	173

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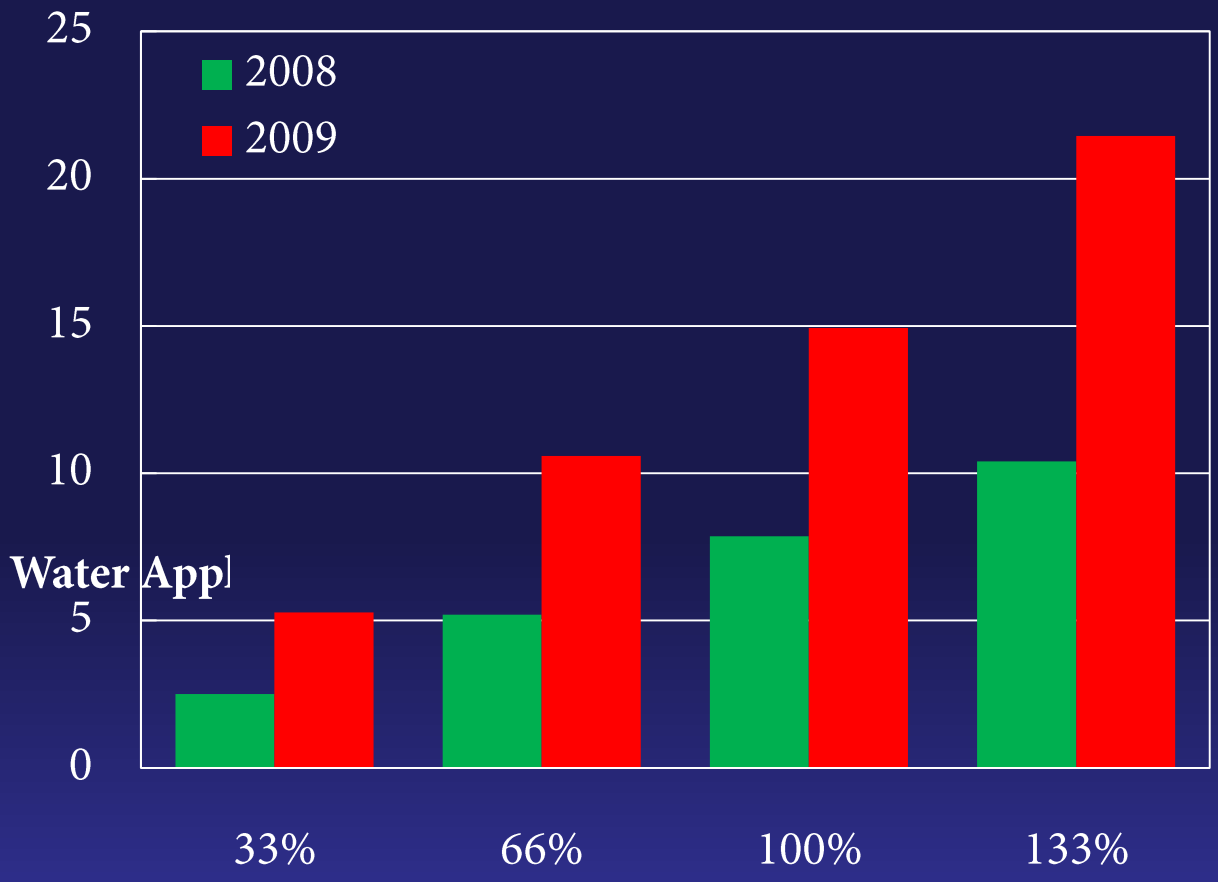

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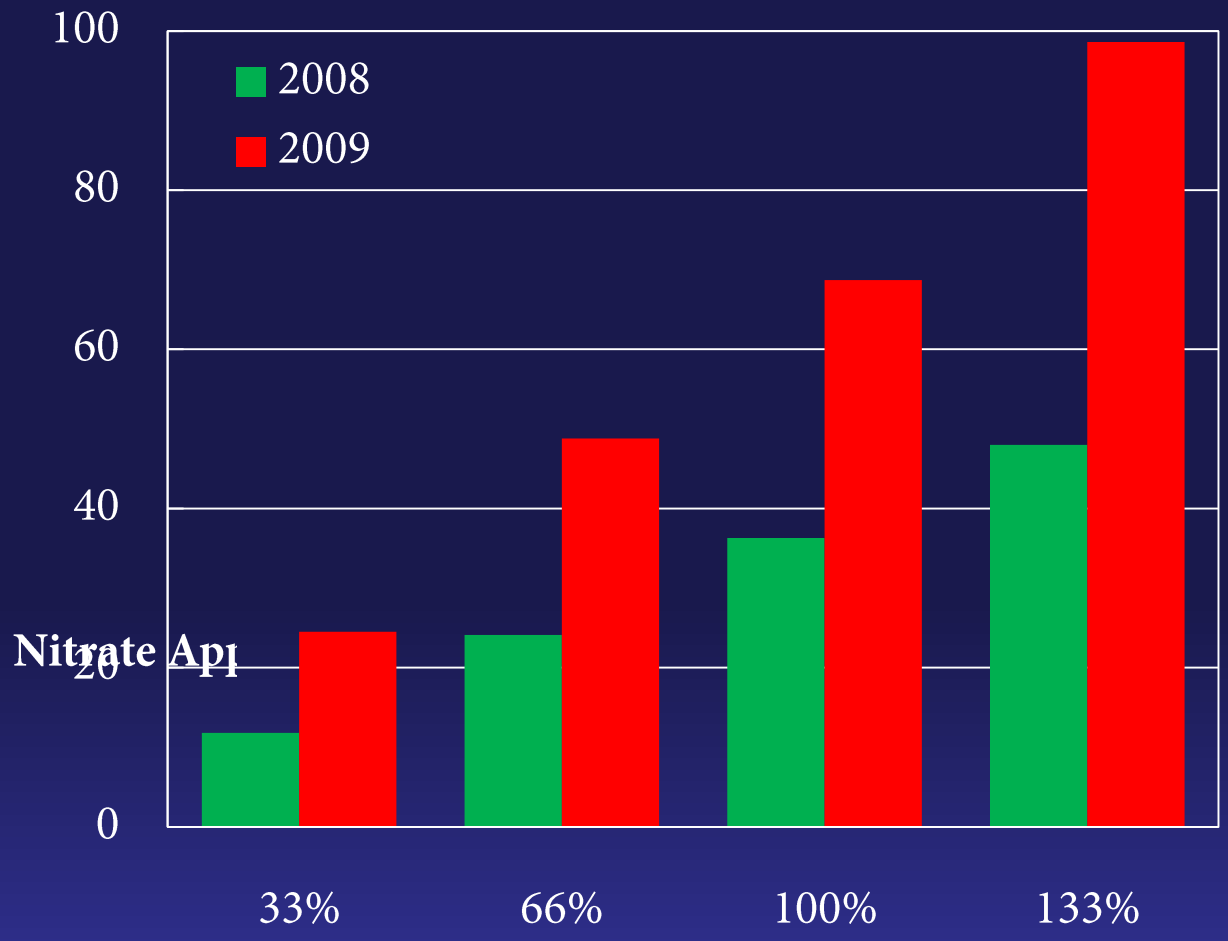


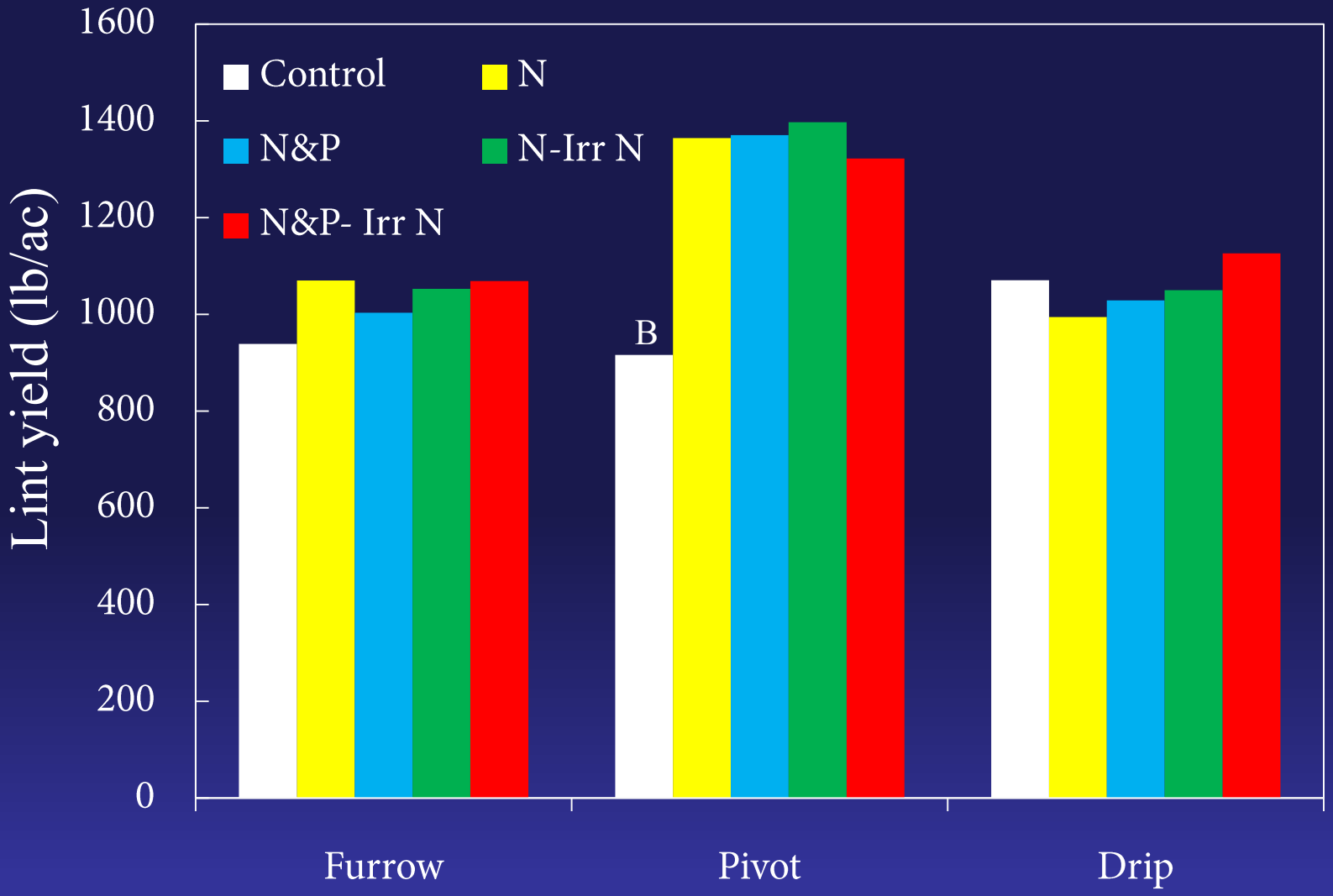
Nitrate Crediting

- Fertility Treatments
  - Unfertilized (Irrigation N Only)
  - N based on soil test
  - N&P
  - N minus irrigation N
  - N minus irrigation N & P
- Irrigation Treatments (100% ET)
  - Furrow, Pivot, Subsurface Drip

Resulting N Application Rates

	Yield Goal (bale/ac)	Residual Soil NO_3 (lb/ac)	Applied N (lb/ac)*	Applied N with irrigation N credit (lb/ac)
Furrow	2	25	75	20
Pivot	3	20	130	75
SDI	3	20	130	75

*70 lb P_2O_5 added to all P treatments



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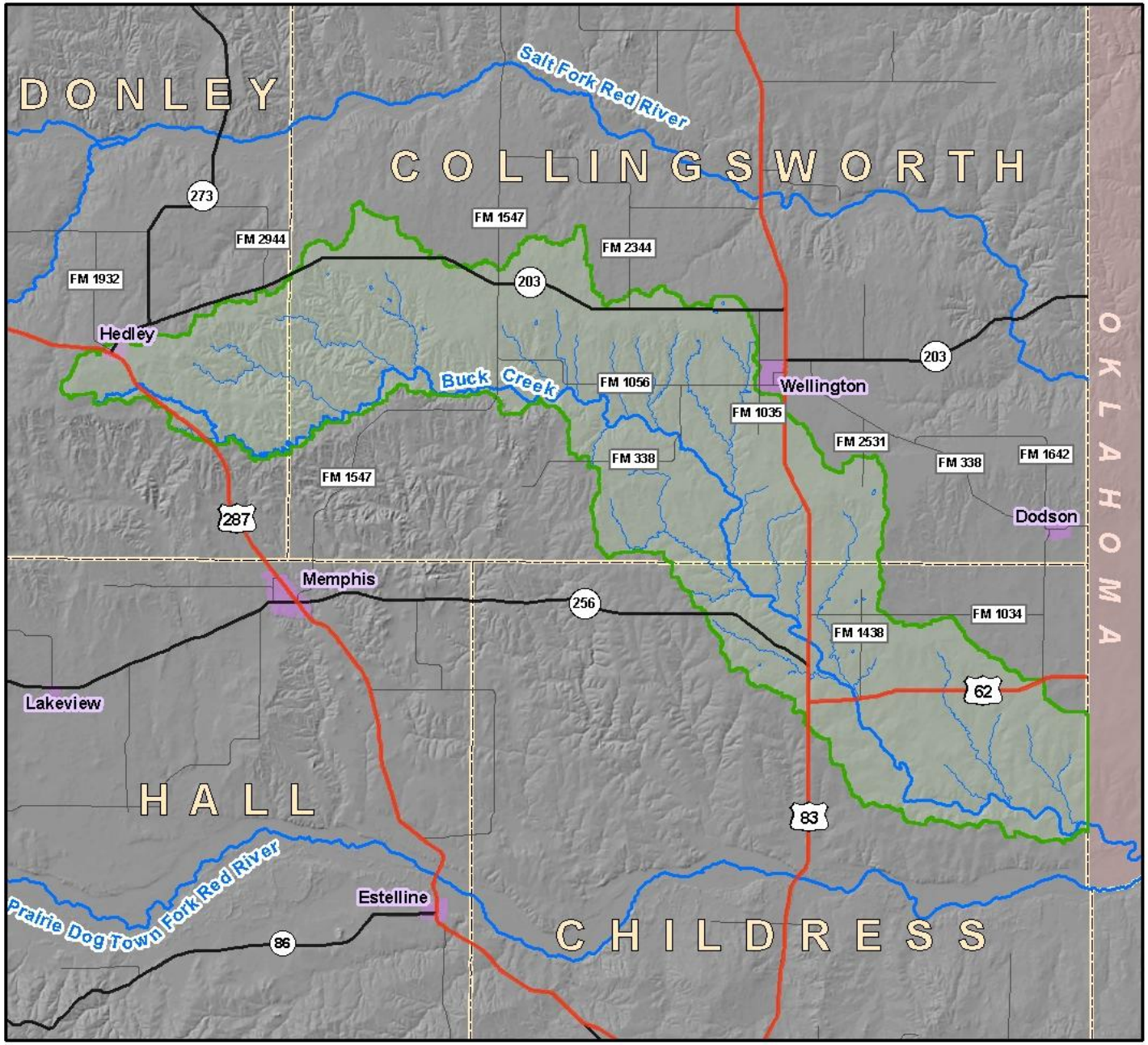
Buck Creek Water Quality

Buck Creek Watershed



Texas Commission on Environmental Quality
Total Maximum Daily Loads Program
Mail Code 150
P.O. Box 13087
Austin, Texas 78711-3087

Buck Creek - Segment 207A

North and Northeast Texas -
Bacteria from Non Point Sources

- U.S. Highways
- State Highways
- Ranch Roads
- Major Streams
- Stream Traces
- Watershed
- City Boundaries
- County Boundaries

0 2 4 8 Miles

Texas Statewide Mapping System (TSMS) Projection

Map Created on May 31, 2002

Buck Creek Water Quality Impairment

- ✓ 303(d) list for *E. coli* (126 CFU/100ml)
- ✓ First Listed in 2000
- ✓ Sources
  - NPS- Wildlife Other than Waterfowl; Unrestricted Cattle Access; Grazing in Riparian or Shoreline Zones; Rangeland Grazing
- ✓ Phase I
  - ✓ May 2004, Bi-weekly water sampling for *E. coli,* isolates submitted for BST analysis (Texas AgriLife Research at El Paso)
- ✓ Phase II
  - ✓ 2006, WPP, continued monitoring

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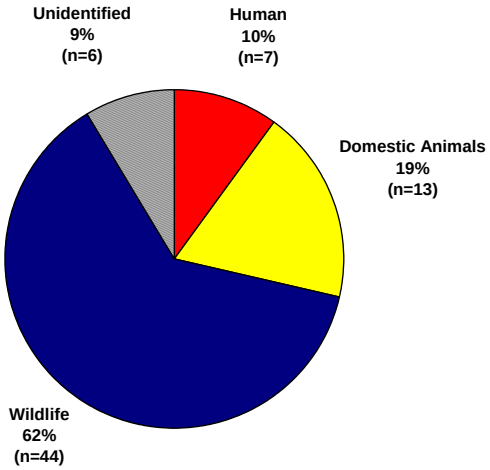
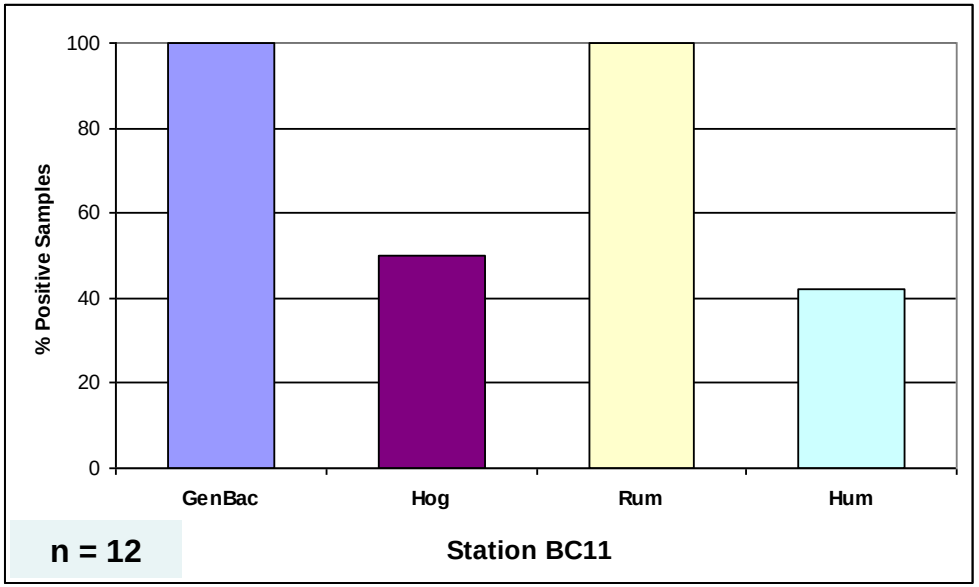
BST Results For Station BC11
US 83; Childress County

E. coli Source Identification



Bacteroidales Marker Occurrence



E. coli **geo. mean during BST sample collection = 14.1 CFU/100 ml**

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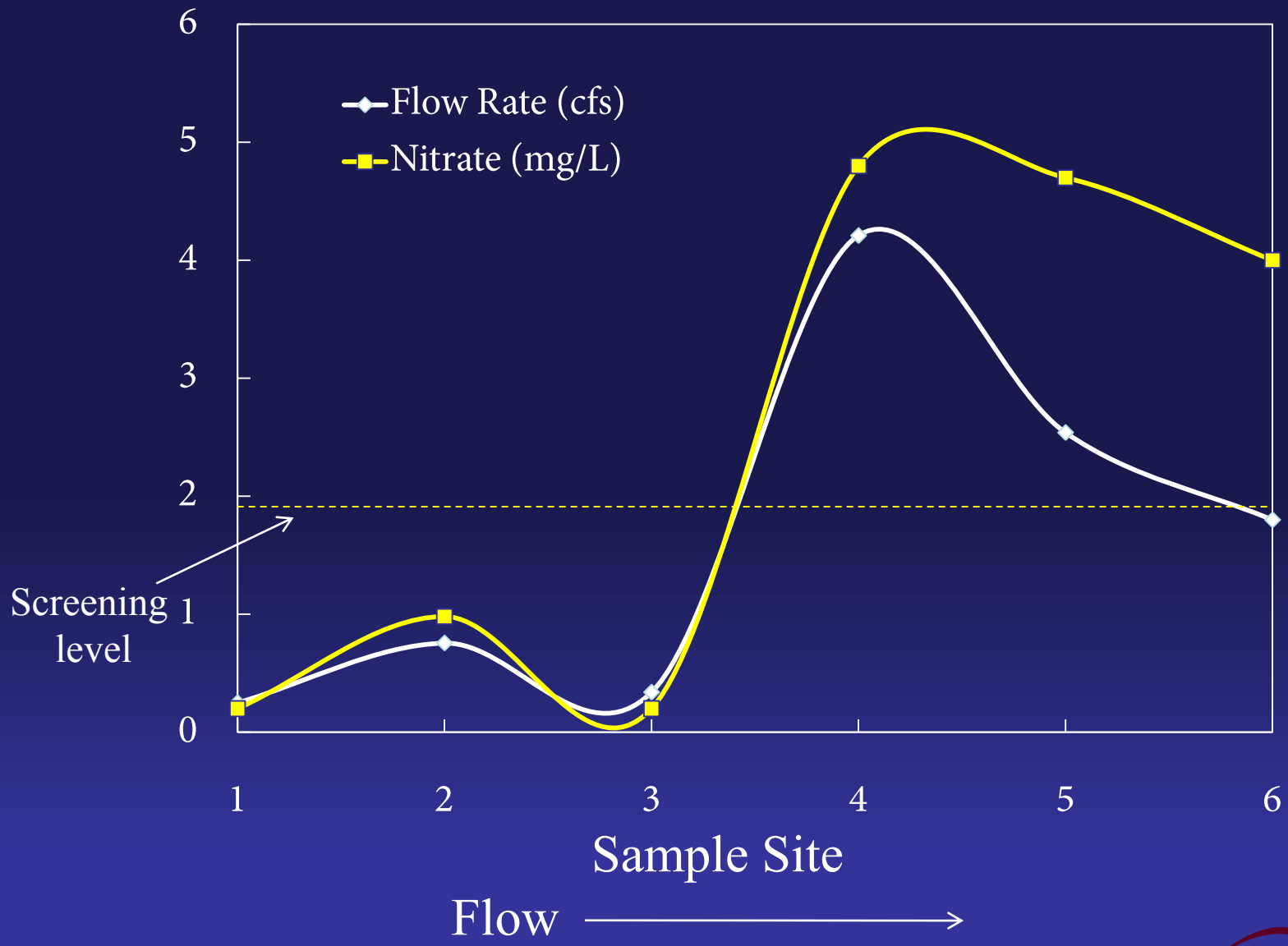
Historical Sampling

Year	N	Geo. Mean (cfu/100ml)	Criteria
E. coli			
2002	14	156	NS
2004	18	309	NS
2010_01	257*	97.6	MEETS
2010_02	192*	44.2	MEETS
Nitrate			
2010	9	3.86	CS

*Samples collected 12/01/01-11/30/08



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Buck Creek Currently

- ✓ Maintain surface water quality monitoring and data collection at previously monitored sites
- ✓ Maintain stakeholder coordination and engagement
- ✓ Analyze samples for *E. coli* and nitrate

Other Water Related Projects

- Tillage in Dual Use Wheat (TWPB)
- Mid-Season N application in wheat (TWPB)
- Tillage and Irrigation in Cotton (Cotton Inc.)
- Tillage and Irrigation in Sorghum (TGSB)
- Irrigation and fertilizer source in Sorghum (OAP)

- Project Websites
  - http://groundwatern.tamu.edu/
  - http://buckcreek.tamu.edu
  - http://manurespreading.tamu.edu